Journal of Geosciences and Environmental Studies: Vol. 2, No. 3, 2025, Page: 1-14

Analysis of Human Resources Readiness in Supporting Energy Transition for National Energy Security

Fakhriyan Ardyanto*, Suyono Thamrin, Rudy Laksmono

Department of Energy Resilience, Faculty of Defense Management, Universitas Pertahanan, Indonesia

DOI: https://doi.org/10.53697/ijgaes.v2i3.4936
*Correspondence: Fakhriyan Ardyanto
Email: fakhriyan.ardyanto@mp.idu.ac.id

Received: 21-09-2025
Accepted: 13-11-2025
Published: 30-11-2025

Abstract: The transition to renewable energy requires competent human resources (HR) to achieve national energy security. This study examines Indonesia's HR readiness for the energy transition through an integrated perspective on energy security and the defense science philosophy. This systematic literature review analyzed 15 high-quality sources (from 30 initially identified, 2020-2025) to examine human resources readiness for Indonesia's energy transition. Using a PRISMA-aligned methodology, 13 key studies (11 journal articles and two institutional reports) were selected for detailed analysis, with two additional sources supporting the development of the thematic framework. The analysis integrates perspectives on energy security, defense science, and defense anthropology to identify HR readiness challenges, with particular emphasis on regional disparities. Despite Indonesia's renewable energy target of 17%-19% for 2025 (revised from an initial target of 23%), current realization remains at only 13.1% (2024), revealing critical competency gaps in the human resources sector. Key findings include: Indonesia ranks sixth globally for energy-sector emissions (691.97 million tons of CO2 in 2022); significant geographic disparities exist, with Java having 204 educational institutions for energy training, compared to only 3 in remote provinces. Required competencies encompass multidisciplinary technical skills, adaptability to technology, and security-aware soft skills. Policy recommendations include energy security-based training programs, competency certification standards, the establishment of an HR energy security council, and the integration of defense anthropology principles into HR development. This research provides a strategic understanding of HR readiness requirements essential for supporting Indonesia's equitable energy transition toward sustainable national energy security.

Keywords: Energy Transition, Human Resource, Energy Security, Renewable Energy

Introduction

The energy transition towards renewable energy sources is a global strategic agenda in facing the challenges of climate change and energy security. Indonesia, as a country with abundant renewable energy potential distributed across its diverse archipelago, initially committed to achieving 23% renewable energy in the national energy mix by 2025. However, as of 2025, the government is reviewing this target downward to 17%-19% for 2025 (IEEFA, 2024), reflecting challenges in renewable energy deployment despite the current 13.1% realization. However, implementing this energy transition faces significant challenges, especially regarding the availability of competent human resources (HR), which varies substantially across Indonesia's geographically dispersed regions.

The uneven distribution of renewable energy potential and infrastructure across Indonesia's archipelago has created pronounced regional disparities in energy sector development and HR capacity. While certain regions, such as Java, possess more developed energy infrastructure and concentrated HR expertise, other regions, including Eastern Indonesia, face critical gaps in technical capacity, skilled labor availability, and institutional support. These geographical disparities present a fundamental challenge to achieving a nationally coordinated energy transition, as the competency requirements and resource availability differ significantly across regions. Understanding this spatial dimension of HR readiness is essential for formulating region-specific strategies that account for local conditions, infrastructure maturity, and existing institutional capacity.

In the context of energy security, a deep theoretical understanding will be an important foundation for understanding the dynamics of the energy transition. Energy security itself does not cover only technical and economic aspects; it also involves social, political, and national security dimensions. The principle of energy security requires the fulfillment of availability, acceptability, affordability, accessibility, and sustainability in the national energy system (Asri & Yusgiantoro, 2020). From a regional perspective, energy security encompasses a region's capacity to develop, maintain, and expand competent human resources to manage renewable energy systems within its geographic and developmental context.

The perspective of defense science shows that energy security is an integral part of national security. The philosophy of defense science invites us to reflect on defense activities, including conflict management, diplomacy, conflict prevention, and the securing of strategic resources, including energy (Aris et al., 2022). In this context, energy plays a critical role as a resource that affects national and regional security stability. The geographic distribution of renewable energy resources and the corresponding HR capacity to develop them represent critical dimensions of both national and subnational security considerations, requiring coordinated development strategies that account for regional differences in institutional maturity and human capital.

In the vision of the Golden Indonesia 2045, Indonesia is expected to become a developed country, with a primary focus on developing superior human resources (HR) (Hadiningrat & Silalahi, 2024), and, of course, this is expected to support the achievement of the energy transition. This vision requires not only national-level HR development but also strategic regional investments to address existing disparities in energy-sector capacity. However, achieving this poses challenges, including managing the safety and security of the energy system across diverse regional contexts, ensuring regional electricity grids can stably accommodate renewable energy, and maintaining adequate technical expertise in each locality.

The energy sector itself is very likely to be a target in the energy transition to reduce carbon emissions from fossil fuels, given that Indonesia is among the largest, with an energy sector emission contribution of 691.97 million tons of CO2 in 2022 (Mahdy et al., 2025). The geographic distribution of this emission burden varies across regions, with specific areas bearing disproportionate responsibility for emissions reduction and, consequently, requiring accelerated HR development to support renewable energy deployment.

The existence of this research is important because there is a real gap between the competency needs of the renewable energy industry and the output of the current education system, particularly when viewed through a regional lens, where disparities are even more pronounced. In the first semester of 2024, the realization of renewable energy reached only 13%, still far from the 23% target by 2025. The challenges range from policy constraints, infrastructure limitations, limited technical capacity and skilled labor, and renewable energy funding support (Abbas et al., 2022; Syabriyana, 2024), and are not uniformly distributed across Indonesia's regions, with some areas experiencing more acute HR shortages than others. Regional variations in educational infrastructure, institutional capacity, and access to technical training programs further compound these disparities.

Therefore, this research aims to analyze the readiness of Indonesia's human resources (HR) in facing the energy transition for national energy security by integrating the theoretical perspectives of energy security and the philosophy of defense science, identifying the main challenges in developing energy sector HR competencies with particular attention to regional disparities and geographic contexts, and formulating region-sensitive policy recommendations to improve HR readiness in supporting an equitable and sustainable energy transition across Indonesia's diverse territories.

Methods

This research uses a qualitative approach and a systematic literature review. Data were collected from various reference sources, including open-access journals, policy documents, and institutional reports, during the period 2020-2025. Following a structured PRISMA-aligned screening process, 13 key sources were ultimately selected for detailed analysis and presentation in this paper (from an initial pool of 30 sources identified through comprehensive database searches).

Literature Selection and Screening Process

The literature screening process followed four main stages to ensure methodological transparency and rigor (Kirana & Hendriani, 2024):

Stage 1: Identification and Source Collection

In this stage, an initial database search was conducted across multiple databases, including Google Scholar, ResearchGate, and institutional repositories, to identify potentially relevant sources. Search terms included "energy transition Indonesia," "human resources renewable energy," "energy security," "energy competency," and combinations thereof. This process yielded an initial pool of 30 potentially relevant sources.

Stage 2: Screening Based on Inclusion and Exclusion Criteria

All identified sources underwent systematic screening based on predetermined inclusion criteria: (1) publications in the period 2020-2025; (2) relevance to the topics of energy transition and human resources in Indonesia; (3) peer-reviewed journal articles, policy documents from government agencies (Ministry of Energy, MEMR), international organization reports (Asian Development Bank, IEEFA, IRENA), and institutional research reports; (4) availability of full text in English or Indonesian language. Exclusion criteria included: (1) sources published before 2020; (2) studies with unclear methodologies or insufficient data; (3) sources that did not specifically address the Indonesian context. Through this screening process, 13 sources were excluded, leaving 17 to proceed to the next stage.

Stage 3: Quality Assessment

The remaining 17 sources underwent quality assessment using a standardized evaluation tool, adapted from the Mixed Methods Appraisal Tool (MMAT), to ensure methodological quality. Sources were evaluated based on the clarity of research objectives, appropriateness of the methodology, validity of the data collection, and relevance of the findings to the research question. Sources with significant methodological limitations were excluded at this stage. This resulted in 15 sources being retained for thematic analysis.

Stage 4: Final Selection and Categorization

From the 15 sources retained after quality assessment, 13 key studies were selected for detailed presentation in Table 1 based on their centrality to the research question and strength of evidence. These 13 studies represent the most directly relevant and high-impact sources. The remaining two sources from the quality-assessed pool were synthesized to support the thematic analysis framework, contributing to theme identification and interpretation without individual detailed presentation. The 13 key studies were distributed as follows: 11 from journals, two from institutional reports, and two from international organization reports.

Table 1 presents a summary of the key reviewed studies, including author(s), publication year, primary focus, and main findings:

Table 1. Summary of 13 Key Studies Selected for Detailed Analysis

Author(s)	Year	Study Focus	Main Findings	Relevance to HR Readiness
Asian Development Bank	2021	Skills assessment for the electricity sector in Indonesia	Only 31 vocational schools offer renewable energy engineering; 1,193 students enrolled; significant geographic disparity with Java having 204 institutions vs. remote areas only 3	Geographic and institutional gaps in HR capacity
Abbas et al.	2022	Solar electricity utilization promotion	Limited community awareness of renewable energy technology implementation	Need for enhanced training and community engagement
Asri & Yusgiantoro	2020	Energy security framework and policy analysis	Five dimensions of energy security (availability, acceptability, affordability, accessibility, sustainability) require HR competency for implementation.	Theoretical foundation for HR readiness in the energy security context
Aris et al.	2022	Philosophy of defense science perspective on energy	Energy security is integral to national defense; it requires specialized competencies	Integration of the security perspective in HR development
Hadiningrat & Silalahi	2024	Golden Indonesia 2045 vision and HR development	Vision emphasizes superior HR development as a foundation for development	Strategic alignment of HR development with the national vision
Hermawan & Prabhawati	2024	Just Energy Transition Partnership (JETP) implementation	Implementation challenges include regulatory and technical gaps; requires coordinated HR development	Practical barriers to energy transition requiring HR solutions
Hidayahl et al.	2020	Defense anthropology and state defense education	Socio-cultural context essential in policy implementation; synthesis of defense science with anthropology needed	Cultural sensitivity is required in HR development programs.
Kirana & Hendriani	2024	Systematic literature review methodology	Structured approach to literature analysis enhances research rigor	Methodological foundation for the current study design
Syabriyana	2024	Progress and challenges in the renewable energy transition	13% realization of renewable energy as of 2024; challenges include limited skilled labor and infrastructure	Evidence of the current HR readiness gap
IEEFA	2024	Indonesia's net-zero emissions pledge progress	Target revised downward from 23% to 17-19% for 2025; policy and implementation gaps identified.	Justification for enhanced HR capacity building

Author(s)	Year	Study Focus	Main Findings	Relevance to HR Readiness
Mahdy et al.	2025	Analyze the effect of CSR disclosure and leverage on financial performance of 45 energy sector companies on IDX (2018-2022)	Indonesia is the sixth-largest CO2 emitter globally (691.97 million tons in 2022). The energy sector contributes 50.6% of emissions; leverage negatively affects profitability; CSR disclosure alone does not improve performance ($F = 5.635$, $Sig = 0.005$, $R^2 = 6.8\%$)	Verifies emissions urgency, justifying energy transition; shows the company Financial constraints limit HR training investment; it reflects regional HR capacity disparities
Wardhana et al.	2024	JETP adaptive governance approach	Institutional and stakeholder coordination challenges require enhanced technical capacity.	HR needs complex energy governance structures.
Yusgiantoro et al.	2024	Energy security nexus in border regions	Regional energy security vulnerabilities: specialized HR needed for resource management in border areas	Regional perspective on energy security and HR

Thematic Analysis Process

Data analysis used thematic analysis to identify patterns and main themes related to HR readiness in the energy transition. The analysis process included three main stages with specific examples of emerging themes:

Stage 1: Coding and Initial Theme Development

In this stage, all reviewed sources were carefully read and analyzed to identify meaningful codes related to HR readiness. Initial codes were inductively derived from the data without forcing predetermined categories, allowing themes to emerge naturally from the literature. Key codes identified included: "skills gap," "geographic disparity," "educational infrastructure," "industry-education disconnect," "competency certification," "training programs," "renewable energy competencies," "soft skills importance," "regional HR distribution," "institutional capacity," and "technology adaptability." For example, multiple sources (Asian Development Bank, 2021; Syabriyana, 2024) were coded as addressing "geographic disparity" when discussing differential access to energy-related educational institutions across regions, with specific examples such as Java having 204 institutions compared to only three institutions in remote provinces.

Stage 2: Categorization and Theme Clustering

Related codes were grouped into broader analytical categories to identify overarching themes. This process resulted in five major thematic clusters: (1) Structural Challenges (geographic disparity, educational infrastructure limitations, funding constraints); (2) Competency Gaps (skills mismatch, lack of multidisciplinary training, insufficient soft skills development); (3) Systemic Barriers (curriculum rigidity, inadequate instructor

qualifications, poor coordination among training providers); (4) Strategic Opportunities (industry-education partnerships, competency certification frameworks, sector-specific councils); and (5) Contextual Integration (integration of energy security perspective, socio-cultural adaptation, defense anthropology principles). For instance, the "Competency Gaps" category consolidated findings from multiple sources, emphasizing that the renewable energy industry requires multidisciplinary technical skills (mechanical, electrical, civil engineering) alongside soft skills such as motivation to learn, self-confidence, and security awareness, aspects that current vocational and tertiary education programs do not adequately address.

Stage 3: Interpretation and Theoretical Integration

The identified themes were then interpreted through the dual theoretical lenses of energy security frameworks and the philosophy of defense science, as articulated by Asri & Yusgiantoro (2020) and Aris et al. (2022). Thematic findings were integrated with theoretical perspectives to produce comprehensive insights into HR readiness. For example, the theme of "geographic disparity" was interpreted not merely as an educational access problem, but as a threat to energy security that requires a coordinated national strategy. Similarly, competency gaps in workforce training were reframed as vulnerabilities in the broader context of national security. This integration process produced key insights, including the recognition that HR development for the energy transition must simultaneously address technical competency, security awareness, and socio-cultural alignment, reflecting the multidimensional nature of energy security as defined by the five pillars (availability, acceptability, affordability, accessibility, and sustainability) identified in the theoretical framework.

Data Synthesis and Validation

To ensure research rigor, thematic findings were cross-validated by examining convergence and divergence across multiple sources. Themes supported by multiple sources (e.g., geographic disparities in HR distribution, as noted by the Asian Development Bank, 2021, and regional energy security considerations, as noted by Yusgiantoro et al., 2024) were given greater weight in the interpretation. Findings were also validated against the theoretical frameworks guiding the study, ensuring coherence between data-derived themes and theoretical predictions regarding energy security requirements and defense science perspectives.

Results and Discussion

Energy security is a multidimensional concept that encompasses a country's ability to provide a stable, affordable, and sustainable energy supply to meet national needs. In the context of the energy transition, energy security focuses not only on diversifying energy sources but also on developing human resource (HR) capacity to manage complex, sustainable energy systems.

The principle of energy security requires the fulfillment of five main dimensions: availability, acceptability, affordability, accessibility, and sustainability. In conditions of financial constraints, achieving these five dimensions simultaneously is certainly not easy, so it is not surprising that decisions are often made solely based on the lowest cost, without considering the overall impact (Asri & Yusgiantoro, 2020).

Perspective of Philosophy of Defense Science

Philosophy of defense science is a branch of philosophy that discusses explicitly various matters related to defense science. The philosophy of defense science invites humans to reflect on defense science activities, including conflict management, diplomacy, war, war prevention, and how to end wars that occur (Aris et al., 2022).

In the context of energy security, the philosophy of defense science provides a perspective on energy as a strategic resource that affects national security stability. Dependence on fossil energy or energy supplies from abroad can create geopolitical vulnerabilities that threaten national sovereignty.

Research shows that threats in regions such as Natuna prompted Indonesia to build military bases to secure its sovereignty over the area, including energy resources important to the economy and development (Yusgiantoro et al., 2024).

Anthropological Theory of Defense

In implementing energy security policies, an approach that considers socio-cultural factors is needed. Defense anthropology theory provides a framework for understanding that the implementation of defense policies, including energy security, requires a synthesis between defense science with socio-cultural nuances and socio-cultural anthropology (Hidayahl et al., 2020).

The concept of defense anthropology holds that the most appropriate way to implement defense policy is to consider a society's socio-cultural context. In the context of the energy transition, this means that human resource (HR) development should not only focus on technical aspects but also consider socio-cultural values and local wisdom in the implementation of renewable energy technology.

Indonesia's Energy Transition Condition from an Energy Security Perspective

Indonesia itself has set ambitious targets for the energy transition, committing to reach 23% renewable energy by 2025 and net-zero emissions (NZE) by 2060. Based on BPS data, Indonesia's renewable energy mix in 2021 reached 12.16%, underscoring the need to accelerate progress to meet the 2025 target.

The Just Energy Transition Partnership (JETP) program launched at the G20 Summit in Bali in 2022 targets a peak emission of 290 Mt CO2eq in the electricity sector by 2030, with a 34% renewable energy mix. The program is supported by a minimum commitment of 20 billion USD from the public sector and private financial institutions to accelerate the decarbonization process (Hermawan & Prabhawati, 2024).

However, the Just Energy Transition Partnership (JETP) implementation plan faces regulatory and technical challenges stemming from stakeholder conflicts of interest, inconsistent regulatory frameworks, opposition from the established fossil fuel industry, and limited implementation capabilities (Wardhana et al., 2024).

From an energy security perspective, these challenges reflect the complexity of balancing the dimensions of availability, acceptability, affordability, accessibility, and sustainability.

HR Readiness Challenges in the Energy Security Framework

Based on research findings and analysis from the perspective of the philosophy of defense science, several main challenges in the readiness of human resources (HR) in the Indonesian energy sector emerge. The challenges referred to are:

a. Geographical Disparity as a Threat to Energy

Security: The lack of skilled labor outside Java is a significant challenge to national energy security. Jakarta has 204 energy-related educational institutions, while provinces such as North Kalimantan and West Sulawesi have only 3 (Asian Development Bank, 2021).

This imbalance affects the availability of competent human resources (HR) for renewable energy projects in remote areas and may create vulnerabilities in the national energy system.

b. Limited Education Infrastructure as a Systemic Challenge

The condition of education infrastructure for providing human resources (HR) in electrical energy remains a significant obstacle, especially in the 3T (Frontier, Outermost, Disadvantaged) areas. In the education sector, for example, only 31 vocational high schools (Sekolah Menengah Kejuruan, or SMK) across the archipelago offer renewable energy courses, with a total of 1,193 students as of March 2020 (Table 2) (Asian Development Bank, 2021). From an energy security perspective, this limitation threatens the accessibility and sustainability dimensions of HR development.

Table 2. Top Competencies Studied in Vocational Schools (SMKs)

Program	Students	Schools Offering the Program
Construction and property engineering	138,348	1,019
Geology and mining engineering	64,936	667
Building engineering	30,774	701
Electrical engineering	4,885	92
Petroleum engineering	2,367	38
Renewable energy engineering	1,193	31

Source: (Asian Development Bank, 2021)

c. Industry-Education Competency Gap in the Context of Energy Security

There is a gap between industry needs and the education curriculum. Most vocational high schools (Sekolah Menengah Kejuruan, or SMKs) and polytechnics still focus on specific skills that are not aligned with the needs of the renewable energy industry, which requires multidisciplinary competencies.

Factors such as unqualified teachers, outdated lessons, poorly equipped schools, and poor certification standards hinder the production of graduates aligned with industry needs and energy security requirements.

Discussion

The results show that the renewable energy sector actually requires human resources (HR) with diverse competencies, which must be adapted to the Indonesian socio-cultural context. Some of the needs of these competencies include:

a. Multidisciplinary Technical Skills with Local Wisdom

The renewable energy industry requires a workforce with multidisciplinary skills, including mechanical, electrical, and civil engineering. However, in the context of defense anthropology, the implementation of this technology must take into account local wisdom and the community's socio-cultural values.

An energy sector engineer needs knowledge and understanding of various engineering fields, as well as sensitivity to socio-cultural context, to operate renewable energy systems safely and efficiently.

b. Technology Adaptability with a Security Perspective

The rapid development of renewable energy technology requires human resources (HR) capable of adapting to new technologies such as energy storage, smart grids, and grid integration. New technologies such as renewable power plants, energy storage, artificial

intelligence, and machine learning in grid management require a workforce that continues to learn and adapt, while considering the security of the energy system.

c. Soft Skills and Attitude in the State Defense Framework

Based on a survey of 19 respondents from the energy sector, more than 80% stated that attitude is an "important" or "very important" factor in employee selection (Asian Development Bank, 2021). In the context of defense science philosophy, the soft skills needed include not only motivation to learn, self-confidence, and open-mindedness, but also awareness of the importance of energy security within state defense.

Education and Training Programs in the Perspective of Energy Security

Indonesia itself has an extensive educational infrastructure for the energy sector. More than 2,500 vocational schools offer programs aligned with the electricity sector, and 383 universities offer electrical and energy programs. PLN Corporate University has 13 education and training centers in various cities, each with a different specialization focus (Asian Development Bank, 2021).

However, there are problems in implementing this education program from an energy security perspective. Many educational institutions have found it quite difficult to find instructors with extensive or recent industry experience. On the other hand, the rigid curriculum, which is challenging to align with industry trends, also poses a significant obstacle to producing graduates aligned with national energy security needs.

Training programs from international donors such as the Asian Development Bank, JICA, and others also often overlap and even contradict each other, due to a lack of coordination. From an energy security perspective, this dependence on external programs can create vulnerabilities in the development of national HR capacity.

Policy Recommendations in the Framework of Energy Security and Defense Science

Based on a comprehensive analysis from the perspectives of energy security and defense science, this research offers recommendations that are expected to serve as a reference for policymakers. Some of these policy strategies include:

a. Development of Energy Security-Based Training

Program. In this case, vocational high schools (Sekolah Menengah Kejuruan, or SMK) and polytechnics need to develop training programs that are not only responsive to market needs but also consider national energy security. The program should be able to track graduates' performance and adjust its offerings based on long-term energy security needs, including courses on energy system security and energy crisis management.

b. Competency Certification with Energy Security Standards

An industry-focused competency certification accreditation body is needed to collaborate with the private sector to develop training programs and certification schemes aligned with national energy security standards. This certification should cover both technical aspects and awareness of the importance of energy security to national security.

c. Establishment of HR Energy Security Council

A high-level coordination council comprising representatives from relevant ministries, PLN, private-sector companies, educational institutions, and defense elements should be established to review existing curricula and training materials from an energy security perspective. The council should recommend updates to new technologies and industry best practices that take into account energy security.

d. Strengthening Cross-Sector Collaboration with a State Defense Perspective

Then, strong collaboration among the government, private sector, educational institutions, and defense elements is needed to create an ecosystem that supports the development of energy human resources (HR) who are aware of the importance of energy security as part of state defense. A holistic approach that includes increasing access to quality education, competency-based training, and mastery of modern technology with an energy security perspective is needed.

e. Implementation of Defense Anthropology Concept in HR Development

The development of energy human resources (HR) must consider the socio-cultural context of Indonesian society. The implementation of renewable energy technology needs to be adapted to local values and traditional wisdom, so that it can be accepted by the community and contribute to sustainable energy security.

Conclusion

The results of this study indicate that Indonesia's human resource (HR) readiness to face the energy transition still faces significant challenges, despite its great potential. By integrating perspectives on energy security and the philosophy of defense science, this research also shows that the main challenges include geographical disparities in the workforce, limited educational infrastructure, and competency gaps between industry and education, all of which have the potential to threaten national energy security.

Competency needs for renewable energy include not only multidisciplinary technical skills and technological adaptability, but also awareness of the importance of energy security within national defense. Existing education and training programs need to be strengthened with an approach that is more responsive to national energy security needs and considers Indonesia's socio-cultural context.

In addition, the implementation of Indonesia's Just Energy Transition Partnership (JETP) program, which focuses on five investment areas for energy transition by utilizing renewable energy as an energy source developed as the primary fuel for power plants, requires the support of human resources (HR) who are not only technically competent, but also have an awareness of the importance of energy security in the context of national security.

The proposed policy recommendations include the development of energy security-based training programs, competency certification with energy security standards, the establishment of an HR energy security council, strengthening cross-sector collaboration with a state defense perspective, and implementing the concept of defense anthropology in HR development.

The implementation of these recommendations is expected to improve the readiness of Indonesian human resources (HR) to support the energy transition, achieve sustainable national energy security, and contribute to national security and stability.

References

Abbas, M. Y. H., Saifudin, H., Nuryaningsih, R. E., & Hadi Sirad, M. A. (2022). Sosialisasi penggunaan listrik tenaga surya di Kecamatan Ternate Tengah. *Journal of Khairun Community Services*, 2(1). https://doi.org/10.33387/jkc.v2i1.4459

Aris, T., Mamahit, D. A., & Ras, A. R. (2022). Pemahaman terhadap filsafat ilmu pertahanan sebagai upaya meningkatkan kemampuan dasar bela negara. *DEFENDONESIA*, 6(1), 58–65. https://doi.org/10.54755/defendonesia.v6i1.116

Asian Development Bank. (2021). *Improving skills for the electricity sector in Indonesia*. https://doi.org/10.22617/TCS210444-2

Asri, N. D., & Yusgiantoro, P. (2020). The energy provision dilemma of coal versus wind from the economic, environmental, and social perspective within the energy security framework. *Jurnal Pertahanan: Media Informasi Ttg Kajian & Strategi Pertahanan yang Mengedepankan Identity, Nasionalism & Integrity*, 6(3), 310. https://doi.org/10.33172/jp.v6i3.1049

Hadiningrat, K. P. S. S., & Silalahi, V. A. J. M. (2024). Efforts to enhance excellent human resources towards Golden Indonesia 2045. *JIPOWER: Journal of Intellectual Power*, 1(3), 52–66. https://doi.org/10.63786/jipower.v1i3.26

Hermawan, L. T., & Prabhawati, A. (2024). Implementasi Just Energy Transition Partnership Indonesia menuju net zero emissions tahun 2060. *Jurnal Energi Baru dan Terbarukan*, 5(3), 28–38. https://doi.org/10.14710/jebt.2024.24161

Hidayahl, Y., Retnasari, L., & Ulfah, R. A. (2020). Membangun sikap bela negara mahasiswa melalui Pendidikan Pancasila di perguruan tinggi. *Ganaya: Jurnal Ilmu Sosial dan Humaniora*, 3(1), 85–100. https://doi.org/10.37329/ganaya.v3i1.424

Institute for Energy Economics and Financial Analysis. (2024). *The dark cloud over Indonesia's pledge to achieve net-zero emissions by 2060*. Retrieved from https://ieefa.org/resources/dark-cloud-over-indonesias-pledge-achieve-net-zero-emissions-2060

Kirana, S. Z., & Hendriani, W. (2024). Flexible working arrangement sebagai kiblat metode kerja di Asia: Tinjauan literatur sistematis. *Psyche 165 Journal*, 348–353. https://doi.org/10.35134/jpsy165.v17i4.439

Mahdy, K. A., & Yanti. (2025). Corporate social responsibility disclosure and leverage on company financial performance. *International Journal of Application on Economics and Business*, 3(1), 398–408. https://doi.org/10.24912/ijaeb.v3i1.398-408

Syabriyana, M. (2024). Progress and challenges of renewable energy transition in Indonesia's energy mix towards net zero emissions. *JURUTERA - Jurnal Umum Teknik Terapan*, 11(02), 76–82. https://doi.org/10.55377/jurutera.v11i02.10810

Wardhana, A. R., Aji, P., Prasetyo, K., Ma'rifatullah, W. H., & Budiarto, R. (2024). Breakthrough on Indonesia's energy policy: Adaptive governance perspective for Just Energy Transition Partnership (JETP). *Journal of Physics: Conference Series*, 2828(1), 012001. https://doi.org/10.1088/1742-6596/2828/1/012001

Yusgiantoro, P., Siagian, U. W., Reksoprodjo, A. H., Gustin, D. R., & Asri, N. D. (2024). Security–energy nexus in Indonesia's border: The case of Natuna. *Indonesian Journal of Energy*, 7(1), 1–15. https://doi.org/10.33116/ije.v7i1.207